

1 the metallic member (84), the guide pins (85), receptacle (86) and the connector
2 (87) are combined together by use of the guide pins (85), but alignment process
3 of the chip (82), the lens array (81) and the fiber cable (80) is complex. One
4 active alignment process is required in mounting the lens array (81) on the
5 separation-setting member (83). In addition, the lens array (81) may become
6 undesirably heated while the lens array (81) is being adhered on the separation-
7 setting member (83). As the lens array (81) is generally made of plastic, such
8 heating may negatively effect the curvature thereof, and thus the stability of light
9 signals transmitted will be impaired. Thus, satisfactory micro-level of alignment
10 in the '262 patent is not achievable.

11 Further, US patent 6,547,454, ('454), discloses another coupling device
12 for optical active components and the lens array. With reference to Fig. 8 (Fig. 4
13 in the '454 patent and wherein the only difference is in the numerals), the optical
14 active component (8) and the lens array (8') are formed as multiple alignment
15 keys (not numbered) by a semiconductor fabricating process. The alignment
16 keys include multiple fine grains (7) and grooves (9). For example, the multiple
17 grains (7) are formed on a surface of the optical active component (8) and the
18 fine grooves (9) are formed on a surface of the lens array (8') corresponding to
19 the fine grains (7). When the optical active component (8) and the lens array (8')
20 are assembled together, the alignment keys increase the accuracy of the
21 alignment between the optical active components and lens array. The '454 patent
22 uses the alignment keys in the semiconductor fabricating process so the
23 alignment between the lens array and optical active components can be
24 successfully achieved at micro-level. However, the lens array and the optical

1 active components must be processed by the semiconductor fabricating process
2 to form the micro-level alignment keys and thus the '454 patent requires a
3 complex fabricating process.

4 The present invention provides an array optical subassembly having a
5 high accuracy of alignment and a simple assembly process.

6 SUMMARY OF THE INVENTION

7 An objective of the present invention is to provide an array optical
8 subassembly that has micro-level alignment and a simple assembly process to
9 increase assembly efficiency.

10 Another objective of the present invention is to provide an array optical
11 subassembly which is suitable for assembling to an array optical assembly
12 according to the SNAP 12 standard.

13 Other objectives, advantages and novel features of the invention will
14 become more apparent from the following detailed description when taken in
15 conjunction with the accompanying drawings.

16 BRIEF DESCRIPTION OF THE DRAWINGS

17 Fig. 1 is a perspective exploded view of a first embodiment of an array
18 optical subassembly in accordance with the present invention;

19 Fig. 2 is a perspective view of Fig. 1;

20 Fig. 3 is a cross sectional plan view along 2-2 line in Fig. 2;

21 Fig. 4 is a perspective view of a second embodiment of an array optical
22 subassembly in accordance with the present invention;

23 Fig. 5 is a perspective exploded view of a third embodiment of an array
24 optical subassembly in accordance with the present invention;

Fig. 6 is a perspective exploded view of an array optical assembly with the array optical assembly as shown in Fig. 5;

Fig. 7 is an exploded view of a prior art optical array sub assembly; and

Fig. 8 is a side view of another prior art optical array sub assembly.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to Fig. 1, a first embodiment of the array optical assembly (10) includes a substrate (11) with a lens array (12), at least one optical active component (20), a driver IC (30), a circuit board (40) and a cover (50).

The substrate (11) is connected to the circuit board (40), the optical active component (20) and drive IC (30).

The substrate (11) has two opposites surfaces (not numbered), one surface is formed as the lens array (12) and the other surface is formed as multiple first, second, and third metal pads (13,14,15), metal lines (16) and multiple alignment keys (17). The second metal pads (14) are respectively connected to the first and third metal pads (13,15) through the metal lines (16). In the first embodiment, all the area of the substrate is made of a glass material or other transparent material. Besides, a specific area of the substrate where the lens array is formed is made of the transparent material. The alignment keys (17) are made of a metal material and are shaped to a rectangular, cruciform, triangular, or other geometric figures.

The optical active component (20) has first multiple terminals corresponding to the first metal pads (13) on the substrate (11), a source array (22) corresponding to the lens array (12) and multiple alignment keys (23) corresponding to the alignment keys (17) on the substrate (11). Optical axes of

1 the source array (22) and lens array (12) are parallel. The source array (22) is
2 composed of multiple lasers or light detectors.

3 The driver IC (30) has multiple second terminals (31) corresponding to
4 the second metal pads (14) on the substrate (11). The drive IC (30) is used to
5 drive the optical active component (20) because the second metal pads (14) are
6 connected to the first metal pads (13).

7 The circuit board (40) has multiple third terminals (41) corresponding to
8 the third metal pads (15) on the substrate (11). The circuit board (40) controls the
9 driver IC (20) because the third metal pads (16) are connected to the second
10 metal pads (14).

11 The cover (50), which is a semi-airtight type or airtight type, covers the
12 substrate (11), the optical active component (20), driver IC (30) and circuit board
13 (40).

14 With reference to Figs. 2 and 3, to assemble the array optical
15 subassembly (10) the optical active component (20), the driver IC (30) and the
16 circuit board (40) are respectively connected to the first, second and third metal
17 pads (13,14,15) on the substrate (11) and then the cover (50) covers these
18 elements. Because the optical active component (20) and the substrate (11)
19 respectively have the alignment keys (23,17), the accuracy of the alignment
20 between the source array (22) and the lens array (12) can be increased. In
21 addition, the optical active component (20) is easily aligned to the substrate (11)
22 by the present semiconductor equipment. Therefore, the alignment can easily
23 and satisfactorily reach micro-level.

24 The circuit board (40) can be a flexible circuit board so the circuit board

(40) is able to be bent to a specific shape. For example, Fig. 4 shows an L-shaped circuit board (40').

With reference to Fig. 5, a second embodiment of the array optical subassembly (10') includes all elements of the first embodiment and further includes a connecting set (19), a fiber connector (192) and two opposite guide rods (18) respectively formed on the lens array surface of the substrate (11). The connecting set (19) has one recess (190) and two opposite holes (191) corresponding to the two opposite guide rods (18) on the substrate (11). The fiber connector (192) has an optical fiber array (193) corresponding to the lens array (12). The two opposite connecting rods (18) on the substrate (11) are respectively inserted to the holes (191) of the connecting set (19) and the lens array (12) faces to the recess of the connecting set (19). The fiber connector (192) is retained in the recess (190) of the connecting set (19). Therefore, the connecting set (19) is connected with the substrate (11) and the fiber connector (192) and the optical fiber array (193) are aligned to the lens array (12) on the substrate (11), wherein optical axes (not numbered) of the optical fibers array (193) and the lens array (12) are parallel.

With reference to Fig. 6, according to the SNAP 12 standard, a 12-channel array optical assembly (not numbered) with the second embodiment of the array optical subassembly (10') is disclosed. The array optical assembly further includes a base (60), a heat sink (63) and a main circuit board (70) with a chip (71).

The base (60) is formed L-shaped corresponding to the L-shaped circuit board (40') so the base (60) has a vertical portion (61) and a horizontal portion

1 (62). The vertical portion (61) has a through hole (611) where the cover (50) of
2 the array optical subassembly (10') is retained. The heat sink (63) is mounted on
3 the horizontal portion (62). The circuit board (40') is connected between the base
4 (60) and the main circuit board (70) and the circuit board (40') is further
5 electronically connected to the chip (71) on the main circuit board (70).

6 Based on the foregoing description, the present invention compares with
7 the '262 patent, and the substrate of the present invention has a function of the
8 separation-setting member of the '262 patent. The substrate is integrated with the
9 lens array thereon so the present invention saves one active alignment process
10 when the lens array is assembled with the separation-setting member. Therefore,
11 the present invention has better accuracy of alignment than the '262 patent.
12 Further, the present invention uses the alignment keys to achieve alignment
13 between the optical active component and the lens array at the micro-level. The
14 optical active component is connected to the substrate by the present
15 semiconductor equipment so the optical active component and the substrate do
16 not require the formation of micro-level alignment keys. Therefore, the present
17 invention has a simpler process and lower cost.

18 Even though numerous characteristics and advantages of the present
19 invention have been set forth in the foregoing description, together with details
20 of the structure and function of the invention, the disclosure is illustrative only,
21 and changes may be made in detail, especially in matters of shape, size, and
22 arrangement of parts within the principles of the invention to the full extent
23 indicated by the broad general meaning of the terms in which the appended
24 claims are expressed.